Stephanie Hatley

EDT 514

**Lesson Plan 3**

* **Lesson Title**
  + Factor a Polynomial in the form ax2+bx+c
* **Short Description of Lesson**
  + Students will learn how to factor a polynomial of the form ax2+bx+c when the leading coefficient, a, does not equal one. This is the first they are seeing this concept but it uses the “bottoms up” method that they learned in the previous lesson. This means they will not be completely unfamiliar with the process, just how it applies to this type of polynomial. Therefore, one day of learning and practicing the method should be enough and one day of incorporating all three lessons to determine “how would you factor this problem?” because that is an important skill to develop.
* **Classroom Layout and Grouping of Students**
  + The classroom is set up in groups of four. This is most conducive to the three main ways the students will be working; in pairs, in groups of four, and on their own. The groups will be arranged so that no student has their back to the Smart Board, which is the main tool I will be using to guide my instruction. Also, the groups are arranged so that each group has various levels of achievement within it (no group will have all A students or all failing students). For this lesson, each student will have paper, a pencil, and a graphing calculator and each group will get one Mobi device.
* **Students’ Present Level of Performance and Skills**
  + The students have worked with the concept of factoring in the previous lesson, during which they factor a trinomial with a leading coefficient of one. This will have laid the groundwork for factoring trinomials with a leading coefficient that is not one. They have used the graphing calculators, Mobi Devices, and the CPS controllers in the past, as well, so we will not need to spend too much time reviewing how to use them.
* **Instructional Objectives**
  + Students will be able to factor a trinomial with a leading coefficient that is not 1 by using the bottoms up method.
  + Students will solve an equation by factoring.
  + Students will learn how to use their calculator to assist in their factoring.
  + Students will check their solutions using a graphing calculator.
  + Students will begin to see how the graph of a standard polynomial changes when the leading coefficient changes.
  + Students will be able to determine, based on the characteristics of the polynomial, which of the three methods they have thus learned would be correct to factor that polynomial.
* **Grade Level Content Expectations**
  + **A1.1.3** Factor algebraic expressions using, for example, greatest common factor, grouping, and the special product identities.
  + **A1.1.4** Add, subtract, multiply, and simplify polynomials and rational expressions.
  + **A1.2.1** Write equations and inequalities with one or two variables to represent mathematical or applied situations, and solve.
  + **A3.5.3** Determine the maximum possible number of zeros of a polynomial function, and understand the relationship between the *x*-intercepts of the graph and the factored form of the function.
* **METS-S: Michigan Education Technology Standards for Students**
  + **9-12.TC.2**. Use an online tutorial and discuss the benefits and disadvantages of this method of learning
  + **9-12.CT.1.** Use digital resources (e.g., educational software, simulations, models) for problem solving and independentlearning
  + **9-12.TC.5.** identify an example of an assistive technology and describe its potential purpose and use
* **Materials, Resources, and Technology**
  + Smart Board
  + Smart Board activities from exchanges.smarttech.com
  + CPS Controllers
  + Mobi Devices
  + Online tutorial from teachertube.com
    - <http://teachertube.com/viewVideo.php?video_id=211585&title=Factoring_Trinomials_Using_Bottoms_Up>
  + Online tutorial from youtube.com
    - <http://www.youtube.com/watch?v=WPuwkQxImmw>
  + McDougal Little Algebra 1 textbook
  + Paper
  + Pencils
  + Graphing Calculators
* **Instructional Procedures**
  + **Day 1:** The class will begin with the students doing the warm up problem, “Factor and solve x2+6x-40” that will be on the Smart Board as they enter. After several minutes a student will be randomly chosen to come up and do the problem on the board. Since we did not have homework the night before, the class will go right into the lesson. The new lesson will begin by watching the youtube and teachertube videos on the Smart Board. Once the videos are over the teacher will begin giving notes on the Smart Board on how to use the bottoms up method to factor and solve a trinomial with a leading coefficient that is not one. Since many students lack the multiplication skills, the teacher will show them how to use the calculator to find the multiples necessary to correctly factor the trinomials. The teacher will work through several examples on the board and address any questions the class has. Next, the students will work with a partner to each complete a problem, given to them by the teacher, and explain to their partner how to do the problems. The teacher will walk around to address any questions and to listen in on the students’ explanations to one another on how to solve the problems. After roughly ten minutes, the average time for a task like this to be completed, the teacher will refocus the students on herself to discuss what they had just done. Once this is done the students will be given a one problem “ticket out the door” using their CPS controllers. The problem “Factor and solve: -6x2-13x-6=0” will be given to them and they will submit their factored equation and the solution using their CPS controllers. Once everyone has submitted an answer and the results are discussed, students will be given the rest of the class period (which would appear to be a max of 10 minutes) to begin their homework assignment from the textbook that will be due the following class period.
  + **Day 2:** Upon entering class, students will be expected to complete the warm-up problem “Factor 4x2+16x+15.” After several minutes a students will be randomly chosen to complete the problem on the Smart Board and then the class will check the homework from the night before in the same fashion they have in the other lessons. Once all questions have been addressed and all work has been handed in to be checked, the students will be asked to get out their graphing calculators. The class will graph a trinomial with a leading coefficient of one and discuss the shape of that parabola. After this discussion, they will graph a trinomial with a leading coefficient greater than one and a trinomial with a leading coefficient less than one. Meanwhile, the teacher is demonstrating the same exercise on the graphing calculator on the Smart Board. The class will discuss the change in the shape of the parabola graphed when these changes are made to the leading coefficient. This will begin to set up the idea of graphing parabolas which will come up next unit. At the point, the students have learned three different forms of polynomials and how to factor them. After a quick review conducted by the teacher, the class will play a game of “I have, who has” with a card given by the teacher. The “I have” cards will have the factored form of a polynomial, and the “who has” cards have the unfactored form. This requires the students to factor the polynomial presented to them, using the best method for that type of polynomial, to see if they have the factored form on their card. This acts as an enjoyable review activity for the students, allows them to continue to build the necessary skills, and allows the teacher to ensure that the students are grasping the concepts. After this the students are given their homework assignment, a worksheet. The students are expected to choice the correct method to factor the polynomial and solve the equation; they are encouraged to use the graphing calculator to check their answers.
* **Supplemental Activities: Extensions and Remediation** 
  + Every day the students will have a warm-up problem on the board for them when they enter class. The first day’s warm-up is to factor and solve a trinomial with a leading coefficient of one, the second day the problem asks them to factor and solve a trinomial with a leading coefficient that’s not one. Also, every day students will have homework assignments that they are to begin in class, so they can hopefully clear up any confusion they are having with the concept, and they are expected to finish before returning to class the next day. The first night the homework assignment will be an assignment from their text book so they can use their book as a reference if needed. The second day the homework assignment will be a worksheet.
* **Assessment**
  + Formal assessment is the homework that is turned in daily.
  + Informal assessments include the CPS mini quiz, the discussion/group work time conducted during class, and the review game.
* **Student Products**
  + The student products include 2 homework assignments.

**TPACK Analysis**

* **Content:** Understand how to factor and solve a trinomial with a leading coefficient that’s doesn’t equal one.
* **Pedagogy:** 
  + Direct Instruction is used when initial teaching the students the new concepts and when explaining the assignments. This allows for the students to get the correct information and to gain initial understanding.
  + Cooperative Learning Groups is used to delve deeper into the content while completing the in class activities. It also allows for the students who are having difficulties with the concept to gain help from a peer.
  + Class Discussions is used to encourage higher level thinking and provide different insight and opinions on the concepts.
  + Independent Work is used to ensure the student is getting practice with the concept and has a good grasp on the material.
* **Technology:** 
  + A Smart Board is used to present information to the students and allow them to share information with one another. It is also used to demonstrate how to use the graphing calculator since the Smart Board has a graphing calculator tool.
  + Online tutorial videos from youtube.com and teachertube.com are presented on the Smart Board to aid in the students learning of the new content and offer than a resource to use as a study tool.
  + Graphing Calculators are used to help with checking the solutions they find after factoring the polynomials and to begin their thinking of how the graph of a polynomial changes as the elements of the polynomial changes.
  + Mobi devices are used by the groups to share their information with the class.
  + CPS controllers are used as an assessment tool.
* **Content Knowledge:**  The teacher has B.S. in Mathematics so they are very competent when it comes to the subject matter. This is also not the teachers first year teaching this content so they have worked with this lesson in the past.
* **Pedagogy Knowledge:** Many of the students struggle with math or do not enjoy the subject. It is the teacher’s responsibility to present the material in a meaningful way by providing real life applications and making it engaging through the use of technology, videos, and group work. This age group of students tends to feel successful when they are able to talk through problems with their peers which is why group work and whole class activities will be utilized a great deal. Also, playing games such as the “I have, Who has” game makes the content enjoyable for the students and they are reviewing and learning without really realizing it. However, in order to gain a good understanding of mathematical concepts, practice and repetition are necessary, hence why daily homework assignments done independently are given. In order for the student, and the teacher, to know if the concept is fully grasped, the student must work independently. Also, though it may not be the most interactive or exciting method of teaching, direct instruction is crucial when introducing a new topic. Finally, by making the students decide which method of factoring must be used helps drive home the concepts they have already learned and makes them aware of the characteristics that set each polynomial apart from one another.
* **Technology Knowledge:** The teacher is currently pursuing an Educational Technology Endorsement and has attended many after school training sessions on how to use all the technologies being used in this lesson. They are more than able to successfully utilize these resources.
* **Pedagogical Content Knowledge:** Many students find mathematics difficult and boring. In order to address these concerns, it is the educator’s responsibility to make the content engaging and to ensure that all students are able to feel success and have an understanding of the content. Allowing the students to make choices in the classroom allows them to feel partially responsible for their education and greatly improves their motivation in the classroom. By allowing the students to choose which method they prefer to use to solve the problems, I am allowing them to feel that their opinions are valued and that they have a say in their learning process. Also, by allowing them to work in groups they are able to help one another with concepts they may not understand and they are more likely to view their learning experience as an enjoyable time because social interaction in involved. Through the implementation of these strategies, I believe I am maximizing learning amongst my students.
* **Technological Content Knowledge:** Since technology is so ingrained in students’ everyday life, incorporating it into the classroom will help enhance their learning experience. This is especially true in mathematics. With the creation of things such as online tutorials and virtual manipulatives, the teaching of mathematics has been greatly enhanced and the likelihood of more children comprehending the concepts has increased drastically. According to a study conducted by Walden University (2010), “"Frequent technology users place considerably more emphasis on developing students' 21st century skills--specifically, skills in accountability, collaboration, communication, creativity, critical thinking, ethics, global awareness, innovation, leadership, problem solving, productivity and self-direction. Frequent users also have more positive perceptions about technology's effects on student learning of these skills--and on student behaviors associated with these skills .On the whole, teachers and administrators reported benefits of technology use for all types of students, from high achievers to students with behavioral and emotional issues.” By incorporating technology into our daily agenda, I am hoping to enhance student learning and retention of the math concepts they are learning.
* **Technological Pedagogical Knowledge:** By implementing technology into this lesson, the students are more likely to be interested in this topic. Allowing them to work in groups and use devices like CPS controllers and Mobi devices, the students would feel that they are active participants in the learning experience. When a task such as coming up to the chalk board to write their homework answer is transformed into using a Mobi tablet to write it on the board from their desk, the students’ level of interest and willingness to participate increases drastically. Furthermore, where a “ticket out the door” used to be a battle, allowing them to submit their answer using a CPS controller and seeing immediate results makes it appear more like a game and provides them, and the teacher, with instant feedback on whether or not the day’s lesson was a success. Also, incorporating things like the online tutorials allows the students to see another “spin” on what the teacher is teaching and provides them with a resource they can use outside of the classroom if they need a “refresher” on the concept while working on homework or studying for their test. My opinion is backed by the staff at Edutopia (2008) who write, “The myriad resources of the online world also provide each classroom with more interesting, diverse, and current learning materials. The Web connects students to experts in the real world and provides numerous opportunities for expressing understanding through images, sound, and text.” The graphing calculator acts in a similar way in this lesson. They are able to see yet another way to find the solutions for their polynomial and now have a great tool to check their work with. When students feel like their tasks are “made easier” they are more willing to do the work even if, in reality, they are still completing the steps they would have.
* **Technological Pedagogical Content Knowledge:** By incorporating all of these elements, it is likely that the students understanding of the concepts and enjoyment of the lesson will be greatly improved. By incorporating technology and various instructional methods while giving the students choices and playing games; more students are likely to find success during this lesson than if the teacher had stood in front of the class and lectured from a textbook and gave them very narrow constraints on their tasks. This lesson incorporates a great deal of differentiation, which is essential in a class full of different ability levels. Therefore, all students should find a moment of success during this lesson. That one moment of success is all that is needed for the student to decide this concept isn’t “stupid” or a “waste of their time” and that will allow them to open up to it.

**References**

# Edutopia Staff. “Why Integrate Technology into the Curriculum?: The Reasons Are Many.” *Edutopia.com* (2008): Web. 24 Feb. 2012.

# Walden University. “Educators, Technology and 21st Century Skills: Dispelling Five Myths.” *The Richard W. Riley College of Education and Leadership* (2010): 1-36. [*www.waldenu.edu/fivemyths*](http://www.waldenu.edu/fivemyths)*.* Web. 26 Feb. 2012